Statewide Pricing Pilot Summer 2003 Impact Analysis

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Presentation Organization

- **Methodology**

- **Treatment impact estimates**

- **Demand models**

- **General conclusions**

- **Additional analysis and next steps**

Methodology

Impact Estimation Methodology

	Control Group	Treatment Group
Pre-Treatment Period	C_1	T_1
Treatment Period	C_2	T_2

$$\text{Impact Measure} = (T_2 - C_2) - (T_1 - C_1)$$

$$\Delta = \Delta_2 - \Delta_1$$

Two Types Of Analysis Were Completed

- ## Treatment Impact Estimates

  - Estimation of the impact of the new rates on energy consumption and peak demand and an assessment of how impacts vary with appliance holdings and weather conditions

- ## Demand Modeling

  - Estimation of demand models that show how prices influence energy use and peak demand and derivation of price elasticities of demand and elasticities of substitution

Treatment Impact Estimates

- **The change in energy use per day by rate period and day type for the typical consumer**

- **Estimated by comparing mean values for the treatment and control groups after adjusting for preexisting differences between the groups due to both observable and unobservable factors**

- **Extrapolation to the state's population using population shares for explanatory variables that interact with the treatment effect**

- **Impacts are specific to the "high" and "low" rate values used in the SPP and cannot be extrapolated to other rate values**

Impacts And Demand Models Were Estimated For Many Day Types And Rate Periods

Rate Type	Day Type	Rate Period			
		Coincident Peak	Peak	Off-Peak	Daily
CPP-F	All Weekdays		X	X	X
	CPP Days	X	X	X	X
	Non-CPP Days		X	X	X
TOU	All Weekdays		X	X	X
	CPP Days	X	X	X	X
	Non-CPP Days		X	X	X
CPP-V	All Weekdays		X	X	X
	CPP Days	X	X	X	X
	Non-CPP Days		X	X	X

Demand Models

- Demand models can be used for predicting the impact of the specific rate values used in the SPP as well as the impact of other rate values

- Demand models yield price elasticities of demand, which are dimensionless quantities that express the ratio of a percent change in the demand for electricity to a percent change in price

- Price elasticities provide a "first-order" means for predicting the impact of new rates on energy consumption and peak demand

- After testing a variety of variables, a decision was made to use the average price from tier 3 as the price term in the demand models

Typical Demand Equation

Ln (On-peak kWh) = A + B1*Ln (On-Peak Price)

+ B2*Ln (Off-Peak Price)

+ C1*(A/C ownership)*(CDH)

+ C2*(Persons Per Household)

+ C3*(Dwelling Type)

+ C4*(Pool/Jacuzzi)

+ C5*(Electric clothes dryer)

+ C5*(Income)

+ ………………………

+ Error Term

SPP Treatment Impact Estimates

CPP Day Peak Period Energy Reductions Vary Significantly Across Climate Zones
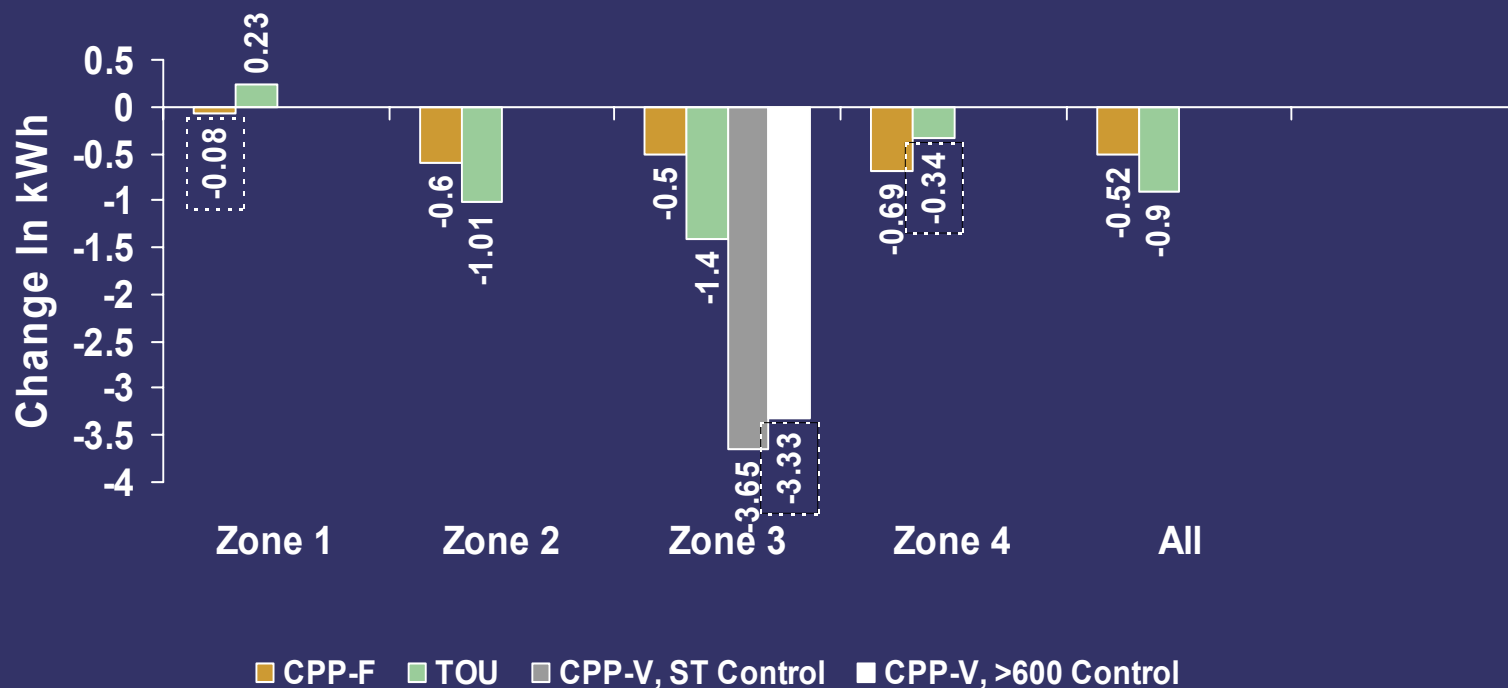

Peak-Period Impact Of Rate Treatments On CPP Days*
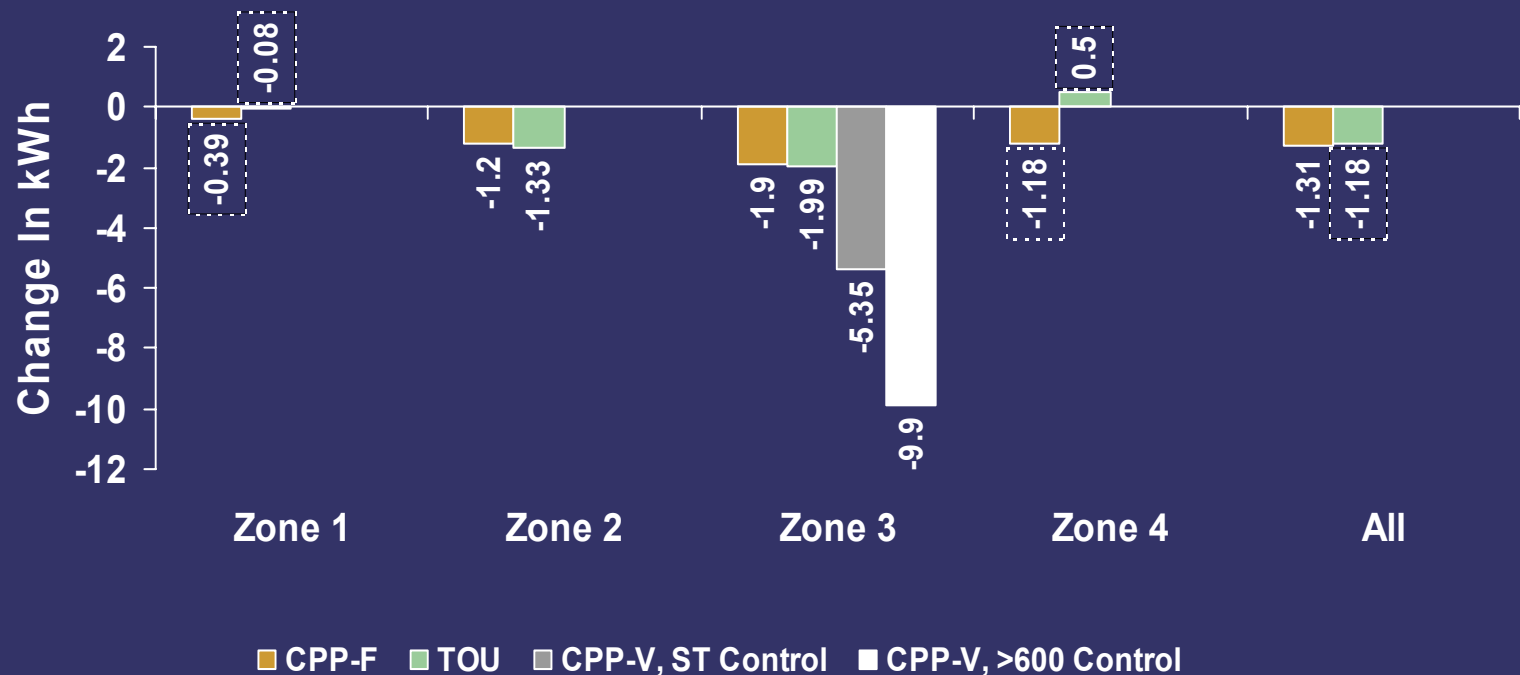
*The figures in dotted boxes are not statistically significant at the 95% confidence level.
The impacts for the CPP-V rate represent households with central air conditioning and are not directly comparable to the other impact estimates.

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Peak Period Energy Reductions Are Lower On Non-CPP Days

Peak-Period Impact Of Rate Treatments On Non-CPP Weekdays*

Legend: ■ CPP-F ■ TOU ■ CPP-V, ST Control ■ CPP-V, >600 Control

Values shown:
- Zone 1: CPP-F = -0.08, TOU = 0.23
- Zone 2: CPP-F = -0.6, TOU = -1.01
- Zone 3: CPP-F = -0.5, TOU = -1.4, CPP-V, ST Control = -3.65, CPP-V, >600 Control = -3.33
- Zone 4: CPP-F = -0.69, TOU = -0.34
- All: CPP-F = -0.52, TOU = -0.9

*The figures in dotted boxes are not statistically significant at the 95% confidence level. The impacts for the CPP-V rate represent households with central air conditioning and are not directly comparable to the other impact estimates.
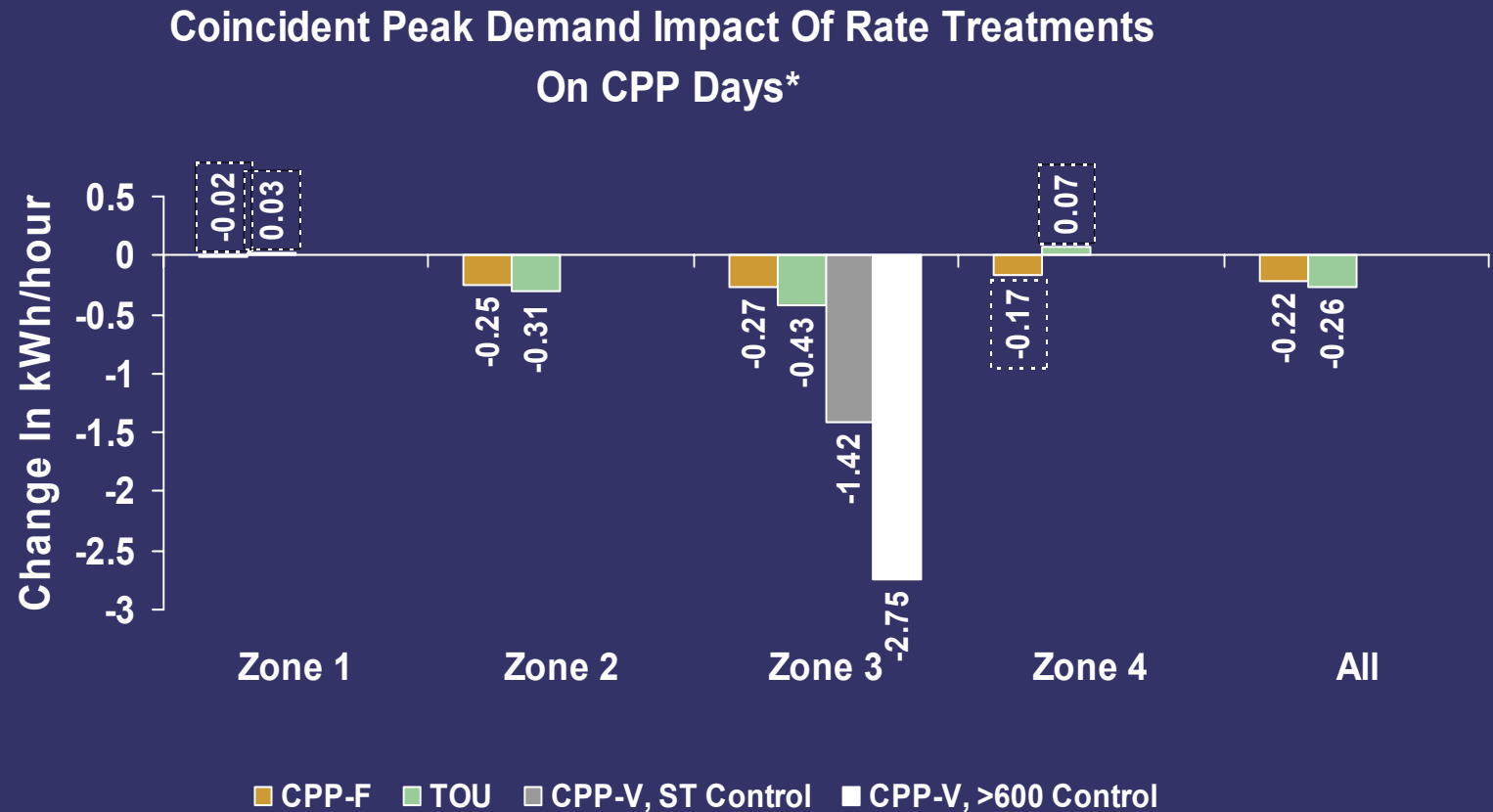
Reductions In Demand At Time Of System Peak Are Greatest In Climate Zones 2 and 3

Coincident Peak Demand Impact Of Rate Treatments On CPP Days*

Change In kWh/hour

Zone 1: -0.02, 0.03
Zone 2: -0.25, -0.31
Zone 3: -0.27, -0.43, -1.42, -2.75
Zone 4: -0.17, 0.07
All: -0.22, -0.26

Legend: ■ CPP-F ■ TOU ■ CPP-V, ST Control ■ CPP-V, >600 Control

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Impact on Peak Period Electricity Consumption

Rate And Day Type	Kilowatt hours (kWh)	Percent
CPP-F rate on CPP Days	-1.3	-22.0
CPP-F rate on non-CPP Days	-0.5	-9.4
TOU rate on all weekdays	-0.9	-16.0
CPP-V rate on CPP Days	-5.4	-38.8
CPP-V rate on non-CPP Days	-3.7	-28.0

Impact On Coincident Peak Demand

Rate And Day Type	Kilowatt hours per hour (kWh/hr)	Percent
CPP-F Rate on CPP Days	-0.2	19.5
TOU Rate on CPP Days	-0.3	23.5
CPP-V Rate on CPP Days	-1.4	49.4

Additional Findings

- **Impacts vary with appliance ownership, being higher for households that own major electric appliances, like a central air conditioners, swimming pools and electric cooktops**

  - Average peak-period energy impact = -0.5 kWh

  - Impact with all 3 appliances = -2.1 kWh

  - Impact with none of the appliances = -0.3 kWh

- **Energy conservation is evident with all rate treatments**

  - CPP-F reduction in daily energy use = 5.7 percent

  - TOU reduction in daily energy use = 8.7 percent

Demand Models

Own-Price Elasticities Of Demand

| Climate Zone	CPP-F CPP Days*	CPP-F Non-CPP Days	TOU All Weekdays
Zone 1	-0.14	**-0.21**	+0.03
Zone 2	-0.24	**-0.26**	**-0.13**
Zone 3	**-0.34**	**-0.50**	**-0.59**
Zone 4	**-0.25**	**-0.25**	**-0.27**

*Values that are NOT in bold type are not significant at the 95% confidence level

A Simulation With The Demand Model

- We simulated the impact of two CPP-F rates on CPP days

- Rate 1 represents the "high" experimental rate. The price during the critical peak period equals 74.2 cents/kWh and equals 8.2 cents/kWh during the off-peak period

- Rate 2 has a lower critical peak price of 50 cents/kWh and the same off-peak rate

- As expected, the impact is smaller in all four zones with the second rate. The all zone average is -1.0 kWh (-21.2%) with Rate 1 and -.6 kWh (-13.5%) with Rate 2

- Note: These impacts will differ from the impacts reported in earlier figures, which combine the effects of the "high" and "low" experimental rates

Demand Models Can Be Used To Predict The Impact Of A Wide Variety Of Rates

Peak-Period Impact of Rate Treatments on CPP Days
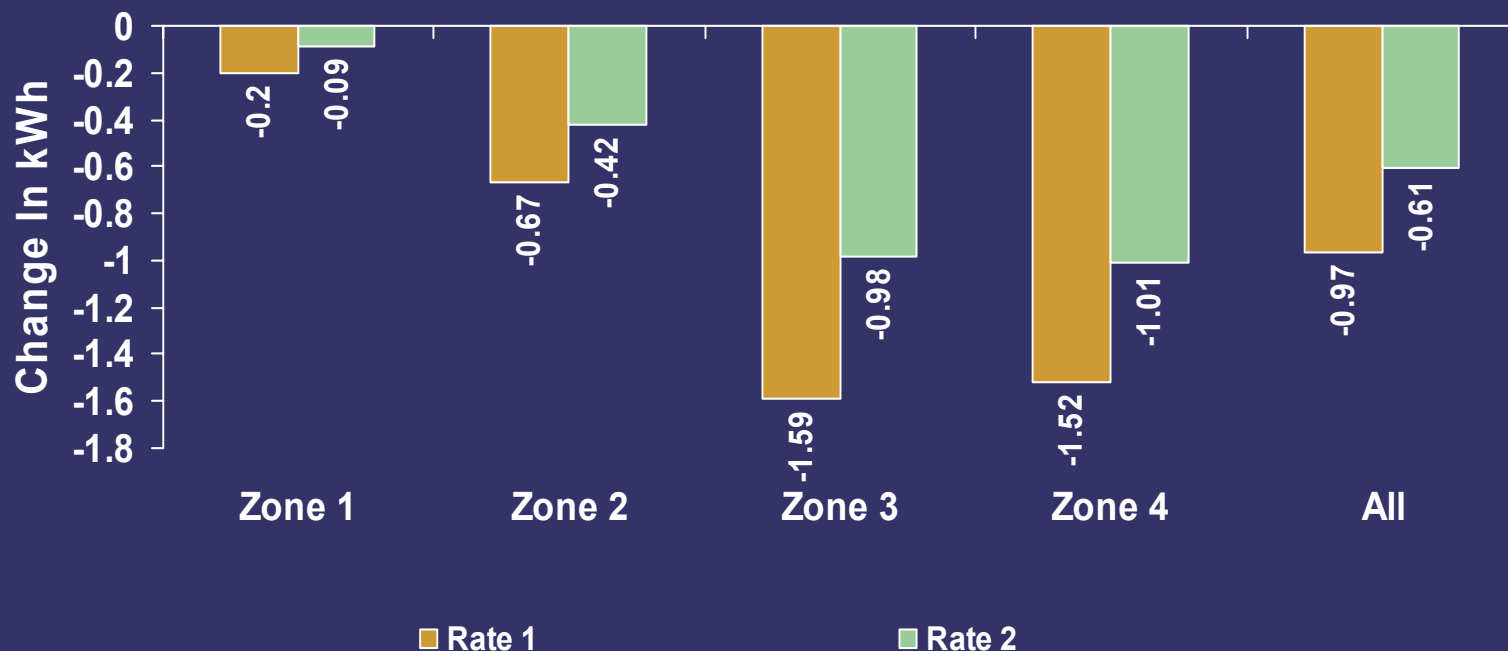
Conclusions

- **Analysis of the summer 2003 data has yielded a wealth of useful statistical information on program impacts**

- **The impacts are in line with prior information and put to rest the theory that California customers have already responded to higher prices and cannot respond any more**

- **They also indicate that coincident peak demand responds as much as the energy consumption during the peak period**

- **The experiment has yielded statistically significant estimates of price elasticities of demand that are in line with the empirical literature on time-varying rates**

Additional Analysis And Potential Next Steps

Ongoing Investigations

- **Divergent impacts for Information Only customers across climate zones and apparent confusion among participants regarding the presence or absence of a price signal as evidenced by End-of-Summer survey**

- **TOU impacts being comparable to CPP-F impacts on CPP days in some zones**

- **Addressing data issues and incorporating survey data into C&I sector analysis**

Work Yet To Get Underway

- **Track B impact analysis and demand modeling**

- **Winter analysis**

  – Key issue—Can the winter analysis be tabled until late spring in favor of other more pressing issues?

- **Web access impact analysis**

Additional Issues

- **Do impacts differ by customer size?**

- **Should a correction be made for potential autocorrelation and heteroskedasticity of the error term in the regression equations?**

- **Does customer load increase immediately following the end of the peak period?**

- **Do price elasticities vary with appliance holdings?**

- **What are the rate impacts on weekends and holidays?**

Additional Issues (continued)

- **Can information from the Momentum Market Intelligence analyses be integrated with the regression models?**

    – Does customer understanding of rates influence responsiveness?

- **Would it be useful to survey those who declined to participate in the pilot, in order to gain additional insights about self-selection bias?**